

~~CONFIDENTIAL~~

Z 65 · 11322

CLASSIFICATION CHANGE

UNCLASSIFIED

To GDS-B011652  
By authority of Shirley Date 12/31/72  
Changed by L Classified Document Master Control Station, NASA  
Scientific and Technical Information Facility

Accessions No. 23426

SID 62-99-17

*Copy #3*  
MONTHLY WEIGHT AND BALANCE REPORT

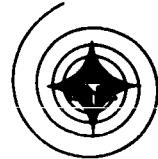
FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150

(U)

1 July 1963

45.45



Prepared By

Weight Control

~~This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U.S.C. Section 703 and 794. Its transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.~~

~~Downgraded at 3-year intervals; declassified after 12 years; DOD DIR 5200.10.~~

**NORTH AMERICAN AVIATION, INC.  
SPACE and INFORMATION SYSTEMS DIVISION**

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~TABLE OF CONTENTS

	ITEM	PAGE
I.	INTRODUCTION	1
II.	MISSION WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY	
	Apollo Lunar Orbital Rendezvous Mission	2
	Apollo Earth Orbit Mission	3
	Apollo Launch Abort Configuration	4
	Command Module Weight, Center of Gravity and Inertia	
	LOR Mission	5
	High Altitude Abort Condition	6
	Low Altitude Abort Condition	7
	Apollo Vehicle Dimensional Diagram	8
III.	CURRENT WEIGHT STATUS	
	Spacecraft Weight Status Summary	9
	Command Module Weight Status	10
	Command Module Changes	11 - 13
	Service Module Weight Status	14
	Service Module Changes	15 - 17
	Launch Escape System Weight Status	18
	Launch Escape System Weight Changes	19
	Adapter Weight Status	20
IV.	WEIGHT HISTORY	21 - 24
V.	POTENTIAL WEIGHT AND C.G. CHANGES	25 - 29
VI.	SPACECRAFT DETAIL WEIGHT STATEMENT	30 - 52

**CONFIDENTIAL**INTRODUCTION

The July report reflects a spacecraft weight increase of 580 pounds at injection and 245 pounds at Service Module burnout.

The major changes in the Command Module were due to the addition of spacecraft up-data link, an increase in nuclear radiation detection equipment, and revised estimates of current electrical requirements.

The major changes in the Service Module were due to the evaluation of instrumentation provisions, an increase in electrical power wiring and distribution, and the increase of the main engine weight.

The major changes in the Launch Escape System were due to an increase in tower insulation thickness and increased ballast weight consistent with combined Command Module and Launch Escape System balance requirement.

An increase in percentage of estimated in lieu of calculated weight is reported in the Command Module Status Chart due to the incorporation of estimates of the redesign in secondary structure and heat shield substructure, and due to incorporation of AiResearch status reflecting 78g effect.

The current injected weight of 83,880 pounds is based on the Service Module loaded with sufficient propellant at a specific impulse of 313.0 to provide 10 per cent  $\Delta V$  margin. This is based on LEM weight, including crew, of 25,000 pounds.

The earth orbital mission weight summary reflects a two stage booster to orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2,465 pounds of propellant.

**CONFIDENTIAL**

~~CONFIDENTIAL~~  
Apollo LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. <sup>2</sup> )		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9310	1042.4	-0.4	8.6	4214	3706	3524
SERVICE MODULE - Less Propellant	9725	908.9	0.8	-0.7	6358	10247	10073
TOTAL - Less Propellant	19035	974.2	0.2	3.8	10662	32339	31896
PROPELLANT - S/M**	37275	905.6	5.7	-2.4	19350	20200	26200
TOTAL - With Propellant	56310	928.8	3.8	-0.3	30200	65442	70975
LUNAR EXCURSION MODULE	24460	623.0	0.0	0.0	13616	12776	13247
ADAPTER - LEM - C-5	3110	640.1	0.0	0.0	6991	8599	8599
TOTAL - Injected	83880	828.9	2.6	-0.2	50866	455863	461925
LAUNCH ESCAPE SYSTEM	6560	1295.6	0.0	-0.1	230	8862	8863
TOTAL - Spacecraft Launch	90440	862.8	2.4	-0.2	51105	75074.5	756816

NOTES : \*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

\*\*The propellant weight of 37275 pounds provides approximately 10%  $\Delta V$  margin, and excludes 210 pounds of  $\Delta V$  propellants tanked in the service module reaction control system. The propellant weight is based on a specific impulse of 313.0.

~~CONFIDENTIAL~~APOLLO EARTH ORBIT MISSIONWEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. <sup>2</sup> )		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9310	1042.4	-0.4	8.6	4214	3706	3524
SERVICE MODULE - Less Propellant	9725	908.9	0.8	-0.7	6358	10247	10073
TOTAL - Less Propellant	19035	974.2	0.2	3.8	10662	32339	31896
PROPELLANT - S/M**	2465	849.1	27.0	-11.7	900	500	650
TOTAL - With Propellant	21500	959.9	3.3	2.1	12014	40325	40255
ADAPTER - C-1	630	779.8	0.0	0.0	545	599	599
TOTAL - Injected	22130	954.7	3.2	2.0	12824	45206	45138
LAUNCH ESCAPE SYSTEM	6560	1295.6	0.0	-0.1	230	8862	8863
TOTAL - Spacecraft Launch	28690	1032.7	2.5	1.5	13070	180978	180917

NOTES : \*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

\*\*The earth orbital weights are based on a complete service module and include 2465 pounds of propellant for an orbital altitude of about 118 nautical miles with a payload launch azimuth of 72°.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~APOLLO LAUNCH ABORT CONFIGURATIONWEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9310	1042.4	-0.4	8.6	4214	3706	3524
LAUNCH ESCAPE SYSTEM	6560	1295.6	0.0	-0.1	230	8862	8863
TOTAL - Launch Abort	15870	1147.1	-0.2	5.0	4507	65884	65640
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3210	1296.5	0.0	0.0	-69	-1330	-1330
TOTAL - LES Burnout	12660	1109.2	-0.3	6.3	4416	45136	44914

F

SID 62-99-17

~~CONFIDENTIAL~~

NOTE: \*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

COMMAND MODULEWEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARYLUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
EARTH LAUNCH	9310	1042.4	-0.4	8.6	4214	3706	3524	-4	-188	-48
ADJUSTMENTS (NET)	88									
Boost & Mission Coolants										
Food & Water Consumption										
Mission Waste Pickup										
Fuel Cell Water Pickup										
PRIOR TO ENTRY	9398	1042.4	-0.8	9.2	4255	3738	3526	12	-210	-71
Less:										
Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-223	1019.7	0.0	11.2						
Entry Coolant	-6	1022.5	-21.1	61.8						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8522	1041.0	-0.8	8.1	3830	3106	2987	1	-116	-69
Less:										
Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	8082	1038.3	-0.9	8.2	3785	2847	2710	-5	-109	-69

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. <sup>2</sup> )					
		X	Y	Z	Ixx	Iyy	Izz	Ixz	Iyz	
EARTH LAUNCH	9310	1042.4	-0.4	8.6	4214	3706	3524	-4	-188	-48
<b>Less:</b> Boost Coolants	-14	1019.4	-38.9	1.4						
PRIOR TO ENTRY	9296	1042.4	-0.3	8.6	4205	3700	3517	-7	-189	-50
<b>Less:</b> Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-223	1019.7	0.0	11.2						
Entry Coolant	-6	1022.5	-21.1	61.8						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8420	1041.0	-0.2	7.4	3777	3065	2978	-16	-97	-47
<b>Less:</b> Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	7980	1038.3	-0.3	7.5	3732	2807	2702	-19	-93	-47

NOTE: Mass inertia data is shown for accumulative totals only.

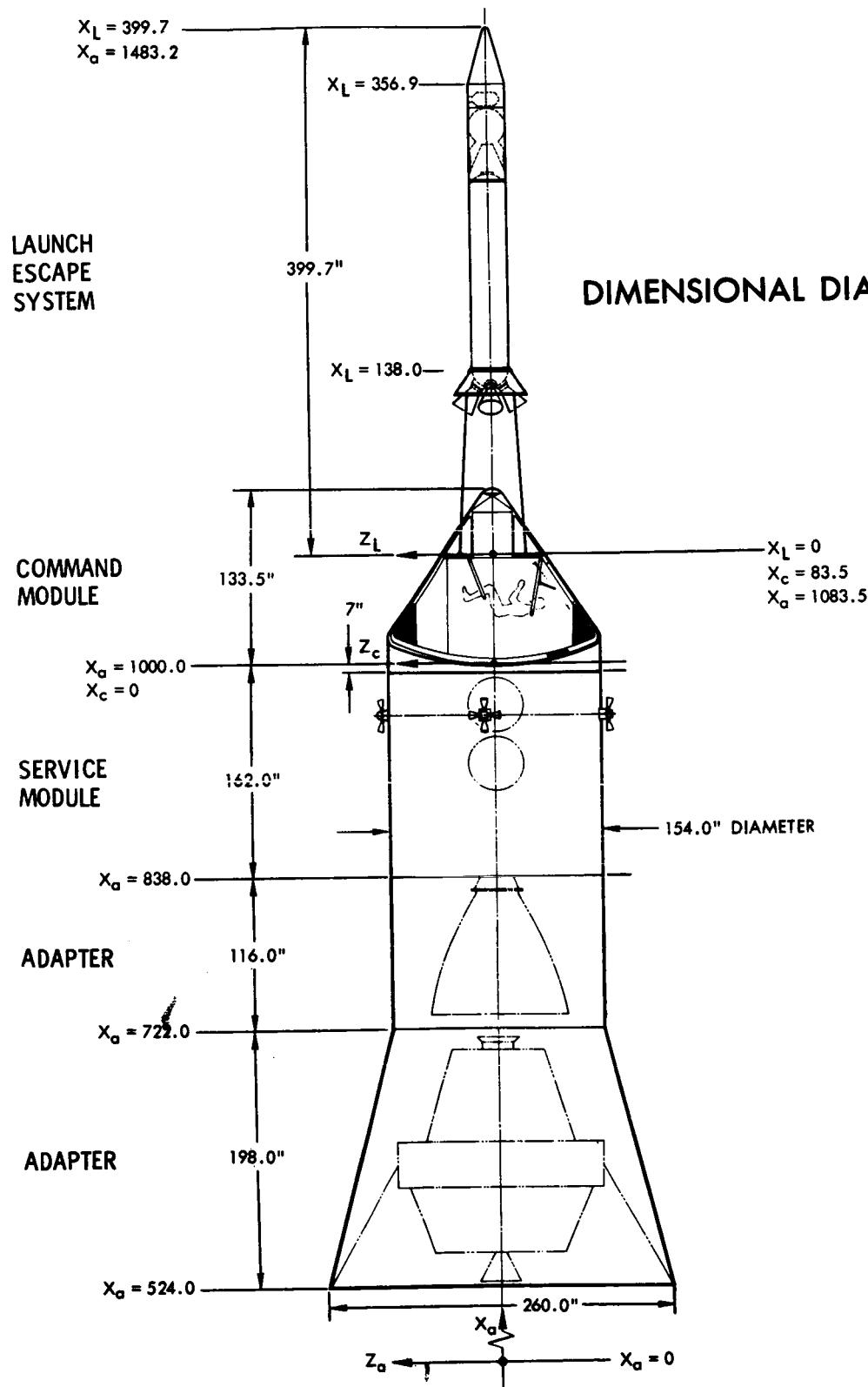
COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. <sup>2</sup> )			
		X	Y	Z	I <sub>xx</sub>	I <sub>yy</sub>	I <sub>zz</sub>	I <sub>xy</sub>
EARTH LAUNCH	9310	1042.4	-0.4	8.6	4214	3706	3524	-4
Less:	-258	1022.6	-6.2	56.6				-188
Propellant	-375	1097.8	-0.3	3.2				-48
Forward Heat Shield	-25	1090.0	11.0	-22.0				
Drogue Chute								
PRIOR TO MAIN CHUTE DEPLOYMENT	8652	1040.5	-0.3	7.5	3942	3230	3133	-12
Less:	-440	1089.9	0.3	6.7				-107
Main Chutes (3)								-46
LANDING	8212	1037.8	-0.3	7.5	3897	2966	2851	-15
								-104
								-46

NOTE: Mass inertia data is shown for accumulative totals only.

~~CONFIDENTIAL~~~~CONFIDENTIAL~~

~~CONFIDENTIAL~~SPACECRAFTWEIGHT STATUS SUMMARY

ITEM	PREVIOUS STATUS 6-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 7-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
COMMAND MODULE	9170	+140	9310	64	34	2
SERVICE MODULE	46560	+440	47000	5	95	-
LES	6390	+170	6560	33	59	8
ADAPTER	3110		3110	100		
TOTAL	65230	+750	65980	20	79	1

~~CONFIDENTIAL~~

COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 6-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 7-1-63	BASIS FOR CURRENT
	(4347) 3070 1277	(+35) +35	(4382) 3105 1277	%EST 100
				%CAL 57
Structure				
Structure - Less Ablator Ablation Material				
Crew Systems	327	+42	327	99
Communication and Instrumentation	712	+9	754	100
Guidance and Navigation	467		476	100
Stabilization and Control	209		209	100
Reaction Control	290		290	100
Electrical Power	391	+39	430	100
Environmental Control	269	+24	293	80
Earth Landing	568	-9	559	11
WEIGHT EMPTY	7580	+140	7720	69
Crew (3), (50, 70, 90 percentile)	528		528	100
Crew System Equipment	299		299	93
Food and Containers	90		90	100
Reaction Control Propellant	259		259	100
Environmental Control Chemicals	164		164	100
Scientific Payload	250		250	100
GROSS WEIGHT	9170	+140	9310	64
				34
				2

~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

STRUCTURE (+35.0)

Increase basic body structure in the crew hatch area due to beaming the compressive loads around the hatch opening.	+19.0
Increase secondary structure due to coldplate dimension change in the right hand equipment bay.	+2.0
Increase the cross sectional area of the aft heat shield ring due to a reduction in heat treat limits to 155,000 psi.	+12.0
Increase aft heat shield to basic body structure attachment due to incorporation of new attachment design using recessed bolts.	+7.0
Decrease forward heat shield nose cone due to chem milling skins from .045 to .008.	-5.0

COMMUNICATION &amp; INSTRUMENTATION (+42.0)

Decrease VHF recovery beacon due to modifying output to an interrupted tone modulated continuous wave to meet NASA directed requirements.	-2.0
Add a spacecraft up-data link for the purpose of providing current Goss data within the spacecraft for display and comparison with the on-board computed data per NASA (CAA No. 54).	+35.0
Increase nuclear radiation detection equipment due to revised estimates based on current system requirements.	+20.0
Delete louspeaker as the requirement for it has been cancelled per NASA (CAA No. 14).	-3.0
Delete antenna selector as the requirement has been eliminated.	-8.0

GUIDANCE &amp; NAVIGATION (+9.0)

Increase Guidance and Navigation System weight due to incorpora- tion of MIT's 15 May 1963 report reflecting new estimates for the navigation base and optical base, correction of the bellows weight and a revised estimate for eye pieces.	+9.0
---	------

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

ELECTRICAL POWER	(+39.0)
Increase inverters due to revised estimate per Westinghouse data.	+3.0
Increase electrical installation provisions due to evaluation of current system hardware.	+10.0
Increase common utility electrical transmission due to changing from a feedthrough on the aft pressure wall to a plug and receptacle manual disconnect.	+7.7
Increase electrical transmission weight due to evaluation of current wiring protection requirements.	+3.5
Increase power distribution weight due to the addition of motor switches in lieu of relays to reduce power requirements and to supply a reliable positive circuit engagement.	+14.8
ENVIRONMENTAL CONTROL	(+24.0)
Increase pressure suit circuit due to the following:	+5.5
Incorporation of AiResearch status reflecting 78g effect on components.	+6.2
Calculation of released ducting drawings in lieu of estimated data.	-0.7
Increase water-glycol circuit due to the following:	+9.3
Incorporation of AiResearch status reflecting 78g effect on components.	+0.4
Calculation of current plumbing drawings reflecting increased wall thicknesses.	+8.9
Decrease pressure and temperature control circuit due to the deletion of the subcontractor cabin vent valves.	-1.7
Increase oxygen supply system due to the incorporation of AiResearch status reflecting 78g effect on components.	+2.4

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

## ENVIRONMENTAL CONTROL (Continued)

Increase water supply system due to the following: +4.6

Incorporation of AiResearch status reflecting 78g effect on components. +1.0

Calculation of current plumbing requirements in lieu of estimates. +3.6

Increase subcontractor common items due to the incorporation of AiResearch status reflecting 78g effect on components. +0.6

Increase component supports due to the effect of 78g. +3.3

EARTH LANDING SYSTEM (-9.0)

Decrease drogue disconnect installation due to using NAA design in lieu of Northrop-Ventura (Responsibility has changed from Northrop-Ventura to NAA). -4.2

Decrease main cluster disconnect due to incorporation of Northrop-Ventura status report reflecting calculated in lieu of estimated weight. -5.5

Increase location aids due to a revised estimate of the weight for the dye marker ejector assembly. +0.7

TOTAL COMMAND MODULE CURRENT WEIGHT EMPTY CHANGES +140.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~  
SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 6-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 7-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	2310	+26	2310	20	78	2
Electronics	151		177	100		
Reaction Control	590		590	69	31	
Electrical Power	1244	+63	1307	17	80	3
Environmental Control	128	-24	104	38	58	4
Propulsion System	(2983)	(+24)	(3007)			
Engine Installation	666	+24	690			
Propulsion System	2317		2317			
WEIGHT EMPTY	7406	+89	7495	30	69	1
RCS Propellant	838		838		100	
Electrical Power Supercritical Fluids	487	+16	503		100	
Environmental Control Supercritical Fluids	208		208		100	
Main Propulsion Helium	99		99		100	
Main Propellant Residuals	(582)		(582)			
Trapped - System	190		190			
Trapped - Engine	67		67			
Mixture Ratio Tolerance	100		100			
Loading Tolerance	225		225			
BURNOUT WEIGHT	9620	+105	9725	23	76	1
Main Propellant	36940	+335	37275		100	
GROSS WEIGHT	46560	+440	47000	5	95	

~~CONFIDENTIAL~~SERVICE MODULECURRENT WEIGHT EMPTY CHANGES

ELECTRONICS SUBSYSTEM	(+26.0)
Decrease high gain antenna due to reflecting current design and vendor information.	-24.0
Increase instrumentation wiring provisions based on current measurement list reflecting current requirements.	+51.0
ELECTRICAL POWER	(+63.0)
Decrease supercritical gas storage system due to incorporating Beech status report as follows:	-7.0
Decrease cryogenic H <sub>2</sub> and O <sub>2</sub> tanks due to the addition of lightening holes in the heater hemispheres.	-7.5
Decrease valve modules in the H <sub>2</sub> and O <sub>2</sub> system due to Beech selecting a different vendor than previously decided upon.	-7.0
Increase oxygen disconnect valve based on re- vised estimate.	+1.2
Addition of cryogenic seal assemblies.	+4.1
Incorporate miscellaneous actual weights.	+1.6
Increase signal conditioners due to revised estimate.	+0.6
Addition of cryogenic system valve module control based on revised system requirements.	+6.0
Decrease cryogenic system electrical wiring due to revised estimates.	-3.0
Increase power distribution weight due to the addition of motor switches in lieu of relays to reduce power requirements and to supply a reliable positive circuit engagement.	+20.0
Transfer electrical provisions from Environmental Control System.	+23.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~SERVICE MODULECURRENT WEIGHT EMPTY CHANGES

## ELECTRICAL POWER (Continued)

Increase electrical power distribution and common utility  
due to revised estimates of wiring, conduit, boxes and  
panels.

+24.1

## ENVIRONMENTAL CONTROL

(-24.0)

Decrease water-glycol circuit due to the following:

-1.0

Incorporation of AiResearch status reflecting  
miscellaneous actual weights on components.

-1.3

Increase supports based on revised estimates.

+ .3

Transfer electrical provision to electrical power system.

-23.0

## MAIN PROPULSION

(+24.0)

Increase main engine weight based on Aerojet's status, due  
to revised estimate for electrical harness and miscellaneous  
valves and plumbing.

+24.0

TOTAL SERVICE MODULE CURRENT WEIGHT EMPTY CHANGES

+89.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~SERVICE MODULECURRENT USEFUL LOAD CHANGES

Increase cryogenic H<sub>2</sub> and O<sub>2</sub> due to filling tanks to design capacity to reflect an electrical load increase from 506 kw-hr to 522 kw-hr.

+16.0

TOTAL SERVICE MODULE CURRENT USEFUL LOAD CHANGES

+16.0~~-CONFIDENTIAL~~



~~CONFIDENTIAL~~

### LAUNCH ESCAPE SYSTEM

#### WEIGHT STATUS

ITEM	PREVIOUS STATUS 6-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 7-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	866	+112	978		100	
Electrical System	41		41	100		
Propulsion System						
Main Thrust	4764		4764	40	60	100
Jettison	440	-6	434			
Jettison Motor						
Skirt	94	-2	92	60	40	100
Pitch Control	55		55			
LES - NO BALLAST	6260	+104	6364	31	61	8
BALLAST	130	+66	196	100		
TOTAL L.E.S.	6390	+170	6560	33	59	8

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMCURRENT WEIGHT CHANGES

## STRUCTURE

( +112 )

Decrease nose cone and ballast support due to incorporation  
of various design changes and revised calculations. -5

Decrease attaching parts based on analysis of current requirements. -4

Increase tower insulation thickness in accordance with revised  
thermal requirements. +137

Decrease escape motor skirt insulation due to revised calculation  
based on current configuration. -16

## BALLAST

( +66 )

Increase ballast consistent with combined Command Module and Launch  
Escape System balance requirements. +66

## PROPELLION

( -8 )

Decrease jettison motor and jettison motor skirt due to incorporation  
of Thiokol status report. -8

## TOTAL LAUNCH ESCAPE SYSTEM CURRENT WEIGHT CHANGES

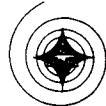
+170

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~ADAPTERWEIGHT STATUS

ITEM	PREVIOUS STATUS 6-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 7-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	2892		2892			
Electrical	76		76			
Separation System	142		142			
TOTAL ADAPTER	3110		3110	100		

~~CONFIDENTIAL~~



NAK Target

CM - 8500

SM - 11000  
45000 - P.W.

ADM 3000

67500

WEIGHT HISTORY COMMENTS

## LAUNCH ESCAPE SYSTEM

The target weight established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original target of 5,900 pounds, as reported in the June Status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

## COMMAND MODULE

The target weight established for the Command Module is 8,500 pounds. An estimated weight breakdown for the target weight is provided for comparative purposes.

The original target weight of 8,340 pounds, as reported in the June Status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

## SERVICE MODULE

The target weight established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the target weight is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original target weight of 8,595 for the burnout condition was based on a lunar landing configuration sized for 31,000 pounds usable propellant.

Fred

How did it happen?

What's been done about it?

When?

~~CONFIDENTIAL~~~~CONFIDENTIAL~~



~~CONFIDENTIAL~~

WEIGHT HISTORYCOMMAND MODULE

	ORIGINAL TARGET WT.	TARGET WEIGHT	AUTHORIZED CHANGES	AUTHORIZED WEIGHT 7-1-63
Structure	3670	3720		3720
Crew Systems	565	690		690
Communication & Instrumentation	944	785	+35	820
Guidance & Navigation	310	310	+150	460
Stabilization & Control	175	195		195
Reaction Control	183	195		195
Electrical Power	354	390	+10	400
Environmental Control	228	255	+2	257
Earth Landing	530	610		610
WEIGHT EMPTY	6959	7150	+197	7347
Crew	528	528		528
Suits & Personal Equipment	82	126		126
Survival Water	54	18		18
Food & Containers	90	90		90
Reaction Control Propellant	210	210		210
Environmental Control Fluids	167	128		128
Scientific Payload	250	250		250
GROSS WEIGHT	8340	8500	+197	8697

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

## COMMUNICATION &amp; INSTRUMENTATION

( +35 )

Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CAA No. 54).

+35

## GUIDANCE &amp; NAVIGATION

( +150 )

Increase the Guidance and Navigation per recent weight report from M.I.T. Since NAA does not have weight control responsibility for the M.I.T. design, the weight changes in their Weight and Balance Report will be considered as authorized changes.

+150

## ELECTRICAL POWER

( +10 )

Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CAA No. 28)

+10

## ENVIRONMENTAL CONTROL

( +2 )

Add a CO<sub>2</sub> sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)

+2

## TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES

+197

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~WEIGHT HISTORYSERVICE MODULE

	ORIGINAL TARGET WT.	TARGET WEIGHT	AUTHORIZED CHANGES	AUTHORIZED WEIGHT 7-1-63
Structure	2810	3203		3203
Electronics	216	145		145
Reaction Control	254	737		737
Electrical Power	1076	1203		1203
Environmental Control	413	250		250
Propulsion System				
Engine Installation	375	606		606
Propellant System	1928	2456		2456
WEIGHT EMPTY	7072	8600		8600
Usable RCS Propellant	400	611		611
Usable Fuel Cell Reactants	280	479		479
Environmental Control Fluids	288	193		193
Main Propulsion Helium	97	139		139
Main Prop. Residuals	300	900		900
Unusable RCS Propellant	20	61		61
Unusable Fuel Cell Reactants	38	17		17
BURNOUT WEIGHT	8595	11000		11000
Main Propellant	31000	45000		45000
GROSS WEIGHT	39595	56000		56000

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESCOMMAND MODULE

## STRUCTURE

( +87 )

Increase basic body structure due to relocation of parachute attach points and change in design criteria to 60,000 pounds resulting in the following:

+84

Upper Longerons	+40
Added Fitting Forward Bulkhead	+13
Pitch Motor Supports	+10
Forward Bulkhead Face Sheets	+7
Cylinder Forward Ring	+9
Forward Hatch	+5

Increase aft sidewall due to change in cabin pressure to 8 psi.

+3

## CREW SYSTEMS

( +8 )

Increase portable life support system per Hamilton Standard letter to NASA.

+36

Delete one portable life support system as analysis of current requirements indicate that only one is required in the Command Module for the lunar mission.

-48

Increase radiation dosimeter per new NASA weights.

+10

Increase suit wiring and umbilicals.

+3

Remove food and personal preference items from survival kit.

-5

Increase waste management system based on calculation of released drawings.

+10

Increase portable light assembly due to refined design criteria.

+2

## COMMUNICATION &amp; INSTRUMENTATION

( +58 )

Add electrical provisions for test instrumentation to monitor C-1 and C-5 booster per NASA.

+16

Add FQ PCM per NASA

+42

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESCOMMAND MODULE

REACTION CONTROL SYSTEM (+35)

Add Command Module reaction control propellant disposal system.  
 This system is designed to dispose of the Command Module  
 propellant prior to impact to eliminate potential explosion  
 and/or fire.

+35

ENVIRONMENTAL CONTROL SYSTEM (-27)

Delete regenerative heat exchanger. -7

Decrease AiResearch components due to reducing requirement  
 to 78g one direction only. -10

Replace re-entry oxygen system with oxygen surge tanks (CAA No. 52) -7

Decrease water-glycol plumbing weight due to analysis reflecting  
 possible wall thickness reduction from .035 to .020 inches. -3

EARTH LANDING SYSTEM (-100)

Decrease parachute weight consistent with incorporation of solid  
 conical parachutes. -105

Decrease parachute supports and attach structure due to reduced  
 loads imposed by the proposed solid conical parachutes. -3

Redesign attach fittings due to change in number required from  
 4 to 2. -7

Increase main cluster harness due to two point attachment. +15

LEM INTEGRATION (+163)

Modify structure to incorporate mating and locking capabilities  
 and to strengthen hatch for mating impact loads. +113

Add rendezvous beacon radar installation as an aid during the  
 rendezvous phase. +50

TOTAL POTENTIAL WEIGHT CHANGES COMMAND MODULE +224

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESSERVICE MODULE

STRUCTURE (-30)

Add provisions for nitrogen purging of the Service Module to prevent accidental explosion on the pad. +15

Replace aluminum honeycomb sandwich in aft heat shield with stiffened fiberglass sheet. -55

Increase density of the honeycomb core in the aft bulkhead sectors II and V. +10

REACTION CONTROL SYSTEM (+35)

Increase system for incorporation of provisions for RCS propellant quantity indication. +35

ELECTRICAL POWER (-55)

Revise the Supercritical Gas Storage System, based on co-ordination with the subcontractor (Beech Aircraft), to include the following changes: -44

Reduction of insulation preloading from 2 to 1/2 psi, H<sub>2</sub> tank. -7

Aluminum outer shell for H<sub>2</sub> tank in lieu of titanium. -5

Aluminum skirt for H<sub>2</sub> tank in lieu of titanium. -3

Pulsating heaters in lieu of electrofilm heaters cryogenic system. -14

Signal conditioners - new source - cryogenic system. -5

Magnetic latching fuel cell valves. -3

Deletion of cryogenic tank shut-off solenoid valve. -5

Aluminum oxygen disconnect valve in lieu of steel. -2

Change space radiator material from 6061 aluminum to 7178 aluminum. -11

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESSERVICE MODULE

## ENVIRONMENTAL CONTROL SYSTEM

(-19)

Change space radiators material from 6061 aluminum to 7178  
aluminum.

-19

## MAIN PROPULSION

(-12)

Redesign main propellant internal tank supports for a reduced  
gauge.

-12

## TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE

-81

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESADAPTER

Increase structure due to the following: +400

Core density increase in honeycomb panels  
and addition of densified core around panel  
joints. +300

NASA responsible changes for providing bumps  
where LEM configuration protrudes through  
the conical section of the adapter. +100

Increase structure due to changing landing gear pad radius from  
164 inches to 180 inches per NASA direction. +300

TOTAL ADAPTER POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES +700

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESUMMARY

ITEM	CURRENT WEIGHT 7-1-63
<u>WEIGHT EMPTY</u>	7720
Structure	4382
Crew Systems	327
Communication & Instrumentation	754
Guidance & Navigation	476
Stabilization & Control	209
Reaction Control	290
Electrical Power	430
Environmental Control	293
Earth Landing	559
<u>USEFUL LOAD</u>	1590
Crew Systems	917
Reaction Control	259
Environmental Control	164
Scientific Payload	250
	—
<u>GROSS WEIGHT</u>	9310

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

DETAIL WEIGHT STATEMENT  
COMMAND MODULE  
STRUCTURE

ITEM	CURRENT WEIGHT	7-1-63
<u>STRUCTURE</u>		
Basic Body Structure	(969)	
Forward Section	161	
Honeycomb Panels	45	
Frames, Rings and Hatches	46	
Fittings and Attachments	70	
Center Section	615	
Honeycomb Panels	206	
Longerons, Frames and Rings	217	
Window and Hatches	107	
Fittings and Attachments	85	
Aft Section	193	
Honeycomb Panel	116	
Ring	77	
Secondary Structure	(543)	
RH Equipment Bay and Coldplates	81	
LH Equipment Bay	60	
Fwd. LH Equipment Bay	15	
Fwd. RH Equipment Bay and Coldplates	26	
Main Display Panel and Coldplates	72	
Lower Equipment Bay and Coldplates	195	
Aft Equipment Bay	44	
Crew Area	25	
Heat Shield Equipment Area	25	
Heat Shield Substructure	(1380)	
Forward Section	203	
Honeycomb Panels	109	
Frames and Rings	27	
Fittings and Mechanism	51	
Strake	16	
Center Section	675	
Honeycomb Panels	235	
Frames and Rings	101	
Doors and Covers	198	
Fittings, Mechanism and Attachments	104	
Strake	37	
Aft Section	502	
Honeycomb Panels	355	
Frames and Rings	46	
Fittings and Attachments	61	
Toroidal Assembly	40	
Ablation Material	(1277)	
Forward Section	139	
Center Section	540	
Aft Section	598	
Insulation	(189)	
Separation Provisions and Attachments	(24)	
TOTAL STRUCTURE	4382	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECREW SYSTEMS

ITEM	CURRENT WEIGHT 7-1-63
Crew Couch Support and Restraint System	30.0
Waste Management	15.0
Lighting Equipment	10.3
Egress Accessories - Hatch	3.0
Case Assembly - Map and Manual	2.0
Structural Seats and Supports	258.0
Nuclear Radiation Detectors	7.0
Shelf Assy. - Work/Food Preparation	1.7
 TOTAL CREW SYSTEMS	 327.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECOMMUNICATIONS AND INSTRUMENTATION

ITEM	CURRENT WEIGHT 7-1-63
<u>TELECOMMUNICATION</u>	
Lower Bay	(302.3)
C-Band Transponder	20.5
Unified S-Band	25.0
S-Band Power Amplifier	20.5
VHF FM Transmitter/HF Transceiver	15.9
VHF AM Trans. -Rec /VHF Rec. Bea.	14.0
Multiplexer	11.6
Spares	19.0
PCM Telemetry Unit No. 1	22.5
PCM Telemetry Unit No. 2	17.5
Signal Conditioner	32.8
Recorder	22.0
Audio Center	8.0
Premodulation Processor	10.0
Central Timing Equipment	8.0
Up Data Link and Provisions	35.0
Nuclear Radiation Detector Equipment	20.0
Remote Equipment	(89.5)
VHF/2-KMC OMNI Antenna & Transmission	7.0
HF Recovery Antenna & Transmission	15.0
C-Band Antenna & Transmission	14.0
VHF Recovery Antenna & Transmission	14.5
TV Camera	4.0
Instrumentation Sensors	35.0
Electrical Provisions	(96.0)
TOTAL TELECOMMUNICATIONS (to be brought forward)	487.8

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

DETAIL WEIGHT STATEMENT  
COMMAND MODULE  
COMMUNICATION AND INSTRUMENTATION

ITEM	CURRENT WEIGHT
	7-1-63
CONTROLS AND DISPLAYS	
Main Display Panel Control Station	(65.2)
Computer Data Insert & Display	15.0
Event Timer	.8
Mode Select	6.9
Delta Velocity	2.5
Flight Director Attitude Indicator	10.5
Gimbal Angle Indicator	6.0
Entry Monitoring Indicator	8.0
Launch Vehicle Emergency Detection System	6.0
Engine Gimbal Control	.7
Command Module Sequencer Control	.5
ELS Sequencer Control & Barometric Indicator	4.2
Launch Escape Control	.6
Crew Safety System	.9
Abort Light	.1
Caution Indicators	2.5
Main Display Panel Center Station	(27.9)
Audio Panel	2.1
Abort Light	.1
CO <sub>2</sub> Warning Lights	.3
Reaction Control	6.7
Service Propulsion	8.6
Central Timing	.2
GMT Clock	.8
Thermal Profile	.5
ECS Liquid Control	2.8
ECS Gas Control	5.8
Main Display Panel System Management Station	(41.6)
Communications Control Panel	8.1
Antenna Control	3.0
Abort Light	.1
Caution Indicators	2.5
Power Distribution	11.0
Fuel Cells	8.6
Cryogenics	6.5
Event Timer	.8
Miscellaneous Telecommunication	1.0
Main Display Panel RH Console	(6.8)
Motor Control Switches	3.6
Audio Panel	2.1
Lighting Control	1.1
Main Display Panel LH Console	(4.9)
Sequencer Arming & Post Landing Control	.9
SCS Power Control	.8
Lighting Control	1.1
Audio Panel	2.1
Electrical Provisions	(29.0)
Lower Equipment Bay	(1.6)
Clock	.8
Event Timer	.8
TOTAL CONTROLS AND DISPLAYS (to be brought forward)	177.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECOMMUNICATION AND INSTRUMENTATION

ITEM	CURRENT WEIGHT
INFLIGHT TEST (RIGHT BAY FORWARD)	(89.2)
Comparator & Power Supply	34.5
Lamps	4.0
Switches	1.4
Meter	1.0
Chassis	8.3
In-Flight Test - GSE Electrical Provisions	<u>40.0</u>
TOTAL IN-FLIGHT TEST	89.2
TOTAL CONTROLS AND DISPLAYS	177.0
TOTAL TELECOMMUNICATION	<u>487.8</u>
TOTAL COMMUNICATIONS AND INSTRUMENTATION	754.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEGUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT
	7-1-63

GUIDANCE AND NAVIGATION

Lower Equipment Bay	
Inertial Platform	59.0
Sextant	12.0
Telescope - Scanning	9.0
Map & Visual Display	8.5
Display & Control - Navigation	23.2
Display & Control - Computer	15.0
Navigation Base	27.2
Computer	97.0
Power Servo Assy	54.7
Coupling Display Unit	16.5
Junction Box	12.2
Cabling - MIT	25.0
Cabling - NAA	16.0
Spares	52.0
Optical Base	21.0
Eye Pieces	3.8
Bellows and Adapter	13.9
Loose Stored Items	10.0
TOTAL GUIDANCE AND NAVIGATION	476.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESTABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT
	7-1-63

STABILIZATION AND CONTROL

Lower Equipment Bay	(178.0)
Rate Gyro Package	6.5
Body Mounted Gyro Package	10.5
Electronic Control Package - Pitch	28.4
Electronic Control Package - Roll	29.1
Electronic Control Package - Yaw	28.4
Electronic Control Package - Auxiliary	30.5
Display/BMAG ECA Package	29.8
Spare Gyro - BMAG (2)	2.0
Spare Gyro - Rate	0.8
Spare Plug-in Module	12.0
 Crew Area Controls	 ( 15.0)
Manual Controls - 3 Axis	7.0
Manual Controls - Translation & Thrust	8.0
 Electrical Provisions	 ( 16.0)
  TOTAL STABILIZATION AND CONTROL	  209.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEREACTION CONTROL SYSTEM

ITEM	CURRENT WEIGHT	7-1-63
<u>REACTION CONTROL SYSTEM</u>		
Propellant Systems		(73.8)
Oxidizer System		36.8
Tanks & Expulsion Devices	14.6	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Fuel System		37.0
Tanks & Expulsion Devices	14.8	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Pressure System		(55.2)
Tanks (4500 psi)	9.5	
Plumbing, Fittings & Insulation	4.8	
Valves & Regulators	38.4	
Sensors	2.5	
Engine System		(138.0)
Engines	96.0	
Nozzle Extension	42.0	
Electrical Provisions		(23.0)
TOTAL REACTION CONTROL SYSTEM		290.0

~~CONFIDENTIAL~~



~~CONFIDENTIAL~~

DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT
	7-1-63

ELECTRICAL POWER

Energy Source	(64.0)
Battery - Re-entry (2)	36.0
Battery - Post Landing (1)	18.0
Battery - Pyrotechnic - Installation	10.0
Power Conversion	(113.0)
Inverter (3) & Control	108.0
Battery Charger & Controls	5.0
Power Distribution & Control	(95.0)
D-C Power Panel Assy	8.6
A-C Power Box Assy	12.7
Battery Circuit Breaker Panel	2.0
Lower Equipment Bay Panel	5.1
Terminal Distribution Panel (Bus)	9.0
Circuit Breaker Panel	4.0
Electrical Transmission(Wiring, Connectors, Cond., Sup.)	34.6
Ground Power Provisions	6.0
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Electrical Common Utility	(158.0)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	75.2
Right Hand Circuit Breaker Panel	13.0
Left Hand Circuit Breaker Panel	7.0
Lighting	5.0
Adapter Separation System	5.0
LFS Separation System	3.5
S/M Pyrotechnic Initiation	3.0
Circuit Utilization Package	12.8
Sequencer	20.0
Installation Provisions	<u>13.5</u>
TOTAL ELECTRICAL POWER	430.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT
	7-1-63

ENVIRONMENTAL CONTROL SYSTEM

Pressure Suit Circuit	(88.2)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	74.8
Ducting, Conn., Clamps, etc.	11.4
CO <sub>2</sub> Sensor	2.0
Water-Glycol Circuit	(58.9)
Subcontractor Res., Evaporator, Pump, Val. & Cont.	28.0
Water-Glycol	18.4
Plumbing, etc.	12.5
Pressure & Temp. Control	(18.8)
Subcontractor Heat Exchg., Blower, Val. & Cont.	18.0
Ducting	0.8
Oxygen Supply System	(21.0)
Subcontractor Entry O <sub>2</sub> Sys., Val. & Cont.	18.0
Plumbing	3.0
Water Supply System	(36.0)
Subcontractor Potable & Waste Tanks & Freon Tank	27.6
Plumbing	8.4
Subcontractor Common Items	(32.2)
Brackets, Plumbing, Elect. Wiring	12.3
Instrumentation	15.8
Radio Noise Filter Spec. Allowance	4.1
Supports	(13.3)
Electrical Provisions	(21.0)
Manual Controls - Push Pull	<u>(3.6)</u>
TOTAL ENVIRONMENTAL CONTROL SYSTEM	293.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEEARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT
	7-1-63

EARTH LANDING SYSTEM

Parachute System	(523.2)
Drogue Chute System	35.5
Main Cluster	419.0
Disconnect Main Cluster	4.0
Pilot Chute System	29.3
Sequence Control	10.7
Attach Provisions	24.7
Location Aids	(10.0)
Forward Heat Shield Release System	(15.8)
Drogue Disconnect Installation	(5.0)
Electrical Pyrotechnic Initiation Provisions	(5.0)
TOTAL EARTH LANDING SYSTEM	559.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEUSEFUL LOAD

ITEM	CURRENT WEIGHT	7-1-63
<u>CREW SYSTEMS</u>	(917.0)	
Crew (3) (50, 70, 90 Percentile)	528.0	
Pressure Garment Assy (3) (NASA)	90.0	
Food	75.0	
Food Containers	15.0	
Personal Hygiene Equipment	15.5	
Biomedical Instrumentation (NASA)	2.0	
Medical Equipment	15.3	
Waste Management	6.9	
Personal Radiation Dosimeter (NASA)	5.0	
Shoe Straps	2.0	
Garments - Constant Wear (NASA)	9.0	
Hose Assembly-Umbilical	17.9	
Hose Assembly-Recharging Backpack	2.8	
Belt Assy Inflight Maintenance, Crewman	1.0	
Map & Maintenance Manual	4.0	
Log Book Assy	1.0	
Lap Board Assy	2.0	
Tool Set Inflight Maintenance	1.0	
Portable Life Support System (NASA)	60.0	
Personal Communications	3.0	
Mouthpiece - Food, Personal	2.0	
Delivery Assy - Water, Personal	1.5	
Provision Assy - Crewman Survival (Collective)	56.1	
Light Assembly - Portable	1.0	
<u>REACTION CONTROL</u>	(259.0)	
RCS Propellant	258.0	
Usable	215.0	
Residual	43.0	
Trapped-System	30.6	
Mixture Ratio	2.4	
Expulsion Efficiency	7.6	
Loading Tolerance	2.4	
RCS Helium	1.0	
<u>ENVIRONMENTAL CONTROL</u>	(164.0)	
Lithium Hydroxide	112.0	
Activated Charcoal	4.0	
Containers for LiOH & Charcoal	13.0	
Oxygen - Re-entry	2.0	
Water-Launch & Re-entry Cooling	10.0	
Freon	10.0	
Water-Earth Orbit Cooling	4.0	
Water-Drinking	4.0	
Water-Mission Cooling	5.0	
<u>SCIENTIFIC PAYLOAD</u>	(250.0)	
<u>TOTAL COMMAND MODULE USEFUL LOAD</u>	1590.0	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULESUMMARY

CURRENT  
WEIGHT  
7-1-63

ITEM	
<u>WEIGHT EMPTY</u>	7495
Structure	2310
Electronics	177
Reaction Control	590
Electrical Power	1307
Environmental Control	104
Propulsion	3007
<u>USEFUL LOAD</u>	2230
Reaction Control	838
Electrical Power	503
Environmental Control	208
Propulsion	681
<u>BURNOUT WEIGHT</u>	9725
<u>MAIN PROPELLANT</u>	<u>37275</u>
<u>GROSS WEIGHT</u>	47000

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULESTRUCTURE

ITEM	CURRENT WEIGHT	DATE
STRUCTURE		7-1-63
Basic Body Structure	(1657)	
Honeycomb Panels - Shell	787	
Radial Beams	393	
Internal Structure and Eng. Compt. Closeout	45	
Forward Bulkhead	155	
Aft Bulkhead	277	
Secondary Structure	(234)	
Tank Support Shelf	33	
Engine Support	41	
Antenna Support	30	
Heat Shields	130	
Insulation	(253)	
Separation Provisions and Attach	(20)	
Fairing	<u>(146)</u>	
TOTAL STRUCTURE	2310	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEELECTRONIC SUBSYSTEM

ITEM	CURRENT WEIGHT	DATE
		7-1-63

ELECTRONICS SUBSYSTEM

Communications	(48.0)
High Gain Antenna	29.0
Antenna	12.2
Gimbals	12.0
Earth Sensor	4.8
Antenna Boom	7.0
Antenna Locking Provisions	3.0
Coax	5.0
Coax Connectors	1.0
Supports	1.0
Wiring	2.0
Instrumentation	(129.0)
Sensors	30.0
Electrical Provisions	94.0
Supports	5.0
TOTAL ELECTRONICS SUBSYSTEMS	177.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEREACTION CONTROL

ITEM	CURRENT WEIGHT	
		7-1-63

REACTION CONTROL SYSTEM

Propellant Systems	(149.0)
Oxidizer System	74.3
Tanks & Expulsion Devices	28.8
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	16.0
Sensors	3.0
Supports	18.0
Fuel System	74.7
Tanks & Expulsion Devices	29.2
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	16.0
Sensors	3.0
Supports	18.0
Pressure System	(128.0)
Tanks (4500 psi)	19.0
Plumbing, Fittings & Insulation	6.0
Valves & Regulators	76.0
Sensors	7.0
Supports	20.0
Engine System	(175.0)
Engines	65.0
Reflectors & Insulation	110.0
Structural Provisions	(80.0)
Electrical Provisions	<u>(58.0)</u>
TOTAL REACTION CONTROL SYSTEM	590.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEELECTRICAL POWER

ITEM	CURRENT WEIGHT
	7-1-63

ELECTRICAL POWER

Fuel Cell Power System	(1144.8)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	731.2
Intermodular - Radiator Plumbing	16.0
Fuel Cell Module Mount Attach	2.0
Fuel Cell H <sub>2</sub> System	
Subcontractor Components	139.0
Plumbing and Valves	3.0
Fuel Cell and RCS O <sub>2</sub> System	
Subcontractor Components	168.0
Plumbing and Valves and Supports	22.0
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	10.0
Space Radiator (Outer Skin)	38.2
Fuel Cell Module Stabilization Webs	2.4
Valve Module Control Box	6.0
Power Distribution	(72.0)
Electrical Transmission	40.0
Power Distribution Box	32.0
Electrical Common Utility	(90.2)
Electrical Transmission	48.0
Sequencer	8.0
Adapter Separation System	7.0
C/M to S/M Separation System	5.0
Pyrotechnic Initiation	12.0
Provisions	10.2
TOTAL ELECTRICAL POWER	1307.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEENVIRONMENTAL CONTROL SYSTEM

ITEM

CURRENT

WEIGHT

7-1-63

ENVIRONMENTAL CONTROL SYSTEM

Water-Glycol Circuit	(93.9)
Subcontractor Valves & Controls	5.6
Plumbing and Hardware	12.8
Water - Glycol	10.0
Supports	5.0
Space Radiator (Outer Skin)	60.5
Water Supply System	(7.1)
Subcontractor Valves & Controls	.1
Plumbing and Hardware	6.0
Supports	1.0
Oxygen Supply System	(3.0)
Plumbing and Supports	<u>3.0</u>
TOTAL ENVIRONMENTAL CONTROL SYSTEM	104.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEMAIN PROPULSION

ITEM	CURRENT WEIGHT	7-1-63
<u>MAIN PROPULSION</u>		
Propellant Systems		(1376.0)
Oxidizer System		765.3
Tanks & Doors	551.0	
Skirts	59.8	
Plumbing, Fittings & Insulation	53.0	
Valves	4.5	
Quantity Indication	35.0	
Mixture Ratio Control	12.0	
Supports - Plumbing & Equipment	50.0	
Fuel System		610.7
Tanks & Doors	458.0	
Skirts	33.2	
Plumbing, Fittings & Insulation	42.0	
Valves	4.5	
Quantity Indication	35.0	
Supports - Plumbing & Equipment	38.0	
Pressure System		(915.0)
Tanks (4400 psi)	774.0	
Tank Supports	30.0	
Plumbing, Fittings & Insulation	24.0	
Valves, Regulators & Heat Exchanger	49.0	
Supports - Plumbing & Equipment	38.0	
Engine System		(690.0)
Engine	690.0	
Electrical Provisions		(26.0)
TOTAL MAIN PROPULSION SYSTEM		3007.0

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEUSEFUL LOAD

ITEM	CURRENT WEIGHT	7-1-63
REACTION CONTROL	(838.0)	
RCS Propellant	835.0	
Usable	790.0	
Residual	45.0	
Trapped System	4.0	
Mixture Ratio	9.0	
Expulsion Efficiency	24.0	
Loading Tolerance	8.0	
RCS Helium	3.0	
ELECTRICAL POWER (Normal Mission)	(503.0)	
Hydrogen - Supercritical Gas	58.5	
Usable (Electrochemical Incl. Tolerance)	46.0	
Unusable (Residual & Instrument Error)	3.2	
Emergency Provisions	4.7	
Expended (Leakage & Purge)	4.6	
Oxygen - Supercritical Gas	444.5	
Usable (Electrochemical Incl. Tolerance)	377.0	
Unusable (Residual & Instrument Error)	17.5	
Emergency Provisions	44.0	
Expended (Leakage & Purge)	6.0	
ENVIRONMENTAL CONTROL (Normal Mission)	(208.0)	
Oxygen - Supercritical Gas	208.0	
Usable (Metabolic)	76.5	
Unusable (Residual & Instrument Error)	9.1	
Emergency Provisions	25.3	
Expended (Leakage, LEM, PLS, Repress)	97.1	
PROPELLION	(681.0)	
Main Propulsion Helium	99.0	
Main Propellant Residuals	582.0	
Trapped - System	225.0	
Trapped - Engine	67.0	
Mixture Ratio Tolerance	100.0	
Loading Tolerance	190.0	
Total Useful Load (Less Main Propellant)	2230.0	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTLAUNCH ESCAPE SYSTEMSUMMARY

ITEM	CURRENT WEIGHT	DATE
<u>LAUNCH ESCAPE SYSTEM</u>		7-1-63
Structure	(978)	
Tower Assy	269	
Escape Motor Skirt	229	
Pitch Motor Structure	157	
Nose Cone and Ballast Support	106	
Attaching Parts	25	
Tower Insulation	182	
Skirt Insulation	10	
Ballast	(196)	
Propulsion	(5345)	
Escape Motor	4764	
Jettison Motor	434	
Jettison Motor Skirt	92	
Pitch Control Motor	55	
Electrical Power	(41)	
TOTAL LAUNCH ESCAPE SYSTEM	6560	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTADAPTERSUMMARY

ITEM	CURRENT WEIGHT	DATE
Structure	(2892)	
Panels	1914	
Frames	422	
Thermal Insulation	556	
Electrical Power	(76)	
Separation System	<u>(142)</u>	
TOTAL ADAPTER	3110	7-1-63

~~CONFIDENTIAL~~